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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/724,127

12/01/2003

Myung Gyu Choi

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JACOBSON HOLMAN PLLC
400 SEVENTH STREET N.W.
SUITE 600
WASHINGTON, DC 20004

EXAMINER

TRINH, MICHAEL MANH

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 07/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/724,127

Applicant(s)

CHOI, MYUNG GYU

Examiner

Michael Trinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 April 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 4-6 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2 and 4-6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 5/2/05.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

*** This office action is in response to Applicant's amendment filed on April 26, 2005. Claims 1-2 and 4-6 are pending, in which claims 4-6 have been newly added.

*** The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

2. Claims 1 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Takashi (JP2002231824).

Takashi teaches a method for forming well in a semiconductor device, comprising the steps of: forming a trench 4 in a semiconductor substrate 1 using a patterned pad nitride film 3 as an etch mask so that a field region is opened (Fig 1; Computer English translation page 3, paragraphs 0021-0023); forming an oxide film 5 along the surface of the trench (Fig 2); performing an additional ion implantation process to form an additional ion implantation layer 6 on sidewalls of the trench 4 (Fig 3; paragraphs 0023-0024,0036); filling the trench with an insulating material 9 to form a field oxide film 9 (Fig 4-5); removing the pad nitride film 3 (Fig 6) and then performing a well ion implantation process to form a well ion burial layer 10/11 in a given depth of the semiconductor substrate 1 (Figs 7-12,13-23; paragraphs 0026-0029; 0037-0045); and forming a well within the semiconductor substrate by an annealing process to diffuse the impurity ion in the well burial layer and the additional ion implantation layer (Figs 7-12; paragraph 0029), wherein the additional ion implantation process and the well ion implantation process use the same type impurity ion, such as boron (paragraphs 0023 & 0028). Re further claim 4, as applied the same to claim 1, in Takashi, wherein the ions are also implanted in a tilt

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so that the ions are implanted only on the sidewalls of the trenches to form ion implantation layer 6 at the sidewalls (Figs 3,10,15,16).

Claim Rejections - 35 USC § 103

3. Claim 2,5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takashi (JP2002231824), as applied to claims 1 and 4 above, and further of Fuse et al (4,918,027).

Takashi teaches a method for forming well in a semiconductor device as applied to claims 1 and 4 above.

Takashi already teaches performing an additional ion implantation process into the trench, but lacks performing the ion implantation in a tilt of 3° to 10° with rotating the device 4 times.

However, Fuse teaches (at Figs 1-2; col 3, line 39 through col 4, line 68; col 1, lines 40-68) performing an ion implantation process into the trench having vertical sidewall surfaces, wherein the ion implantation is performed in a tilt angle of 8° with rotating the device 4 times.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the additional ion implantation process of Takashi by performing the ion implantation in a tilt angle of 8° with rotating the device 4 times, as taught by Fuse, when the isolation trench having vertical sidewall surfaces. This is because of the desirability and the necessary to introduce ion dopants into the sidewall surfaces of trench. Moreover, selecting of a tilt angle for ion implantation as taught by Fuse, which is within the range of applicant's claims, would have been obvious, involve routine optimization which has been held to be within the level of ordinary skill in the art, and would be an unpatentable modification, *In Re Aller* 104 USPQ 233,255 (CCPA 1955); *In re Waite* 77 USPQ 586 (CCPA 1948); *In Re Swanson* 56 USPQ 372 (CCPA 1942).

4. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Puchner et al (6,342,429) taken with Shih et al (6,362,035).

Puchner teaches a method for forming a well in a semiconductor device comprising at least the steps of: forming a trench 260 in a semiconductor substrate using a patterned pad

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nitride film 204 as an etch mask (Figs 2A-2B; col 3, lines 30-50) so that a field region is opened; forming an oxide film 208 along the surface of the trench (Fig 2C; col 3, lines 58-67); performing an additional ion implantation process (col 3, line 63 through col 4, line 22) to form an additional ion implantation layer on the sidewalls of the trench (Fig 2D); filling the trench with an insulating material 220 to form a field oxide film (Fig 2E; col 4, lines 23-35); and removing the pad nitride film 204 and then forming a well 240/250 implantation process to form a well ion burial layer in a given depth of the semiconductor substrate 200; and forming a well within the semiconductor substrate, wherein the additional ion implantation process and the well ion implantation process use the same type impurity ion, such as boron (col 4, lines 43-67; col 2, lines 10-19; col 1, lines 44-64), wherein the additional ion implantation process and the well ion implantation process use the same impurity ion of p-type dopant, such as boron (col 4, lines 16-23, 43-67; col 2, lines 10-19; col 1, lines 44-64; col 3, lines 63-67).

Puchner already teaches a well ion implantation process, but lacks mentioning a subsequent annealing process.

However, Shih et al teach (at col 5, lines 24-34, 2-23; Figs 1g-1i), after implanting ions into the substrate to form the well, performing a subsequent annealing process to electrically activate the implanted ion impurities.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the well of Puchner by performing an annealing process after the well ion implantation process, as taught by Shih. This is because at least of the desirability to electrically activate the implanted ion impurities.

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Puchner et al (6,342,429) taken with Shih et al (6,362,035), as applied to claim 1 above, and further of Fuse et al (4,918,027).

Puchner and Shih teach a method for forming well in a semiconductor device as applied to claim 1 above.

Puchner already teaches performing an additional ion implantation process into the trench, but lacks performing the ion implantation in a tilt of 3° to 10° with rotating the device 4 times.

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However, Fuse teaches (at Figs 1-2; col 3, line 39 through col 4, line 68; col 1, lines 40-68) performing an ion implantation process into the trench having vertical sidewall surfaces, wherein the ion implantation is performed in a tilt angle of 8° with rotating the device 4 times.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the additional ion implantation process of Puchner by performing the ion implantation in a tilt angle of 8° with rotating the device 4 times, as taught by Fuse, when the isolation trench having vertical sidewall surfaces. This is because of the desirability and the necessary to introduce ion dopants into the sidewall surfaces of trench. Moreover, selecting of a tilt angle for ion implantation as taught by Fuse, which is within the range of applicant's claims, would have been obvious, involve routine optimization which has been held to be within the level of ordinary skill in the art, and would be an unpatentable modification, *In Re Aller* 104 USPQ 233,255 (CCPA 1955); *In re Waite* 77 USPQ 586 (CCPA 1948); *In Re Swanson* 56 USPQ 372 (CCPA 1942).

Response to Arguments

1. Applicant's remarks filed April 26, 2005 have been fully considered but they are not persuasive, and in moot in view of the new ground(s) of rejection.

**** Applicant's remarks (remark page 5) that "...Puchner et al. clearly fails to disclose or suggest the feature of forming an additional ion implantation layer on the sidewalls of the trench...".**

In response, this is noted and found unconvincing. As clearly shown in Figure 2D (col 4, lines 10-15), ions are also implanted into sidewalls of the trench 206.

**** Applicant's remarks (remark page 6) that "...Puchner patent discloses boron ion for the P-well ion and indium ion implanted at the bottom of the trench. Therefore, Puchner et al. further fails to disclose or suggest the same type impurity ion".**

In response, this is noted and found unconvincing. Although Puchner teaches boron ion for the P-well ion and indium ion implanted into the trench instead of boron, Puchner still discloses boron ion for the P-well ion and boron ion implanted at the sides of the trench for field implantation, wherein the well ion implantation process and the field implant use the same type impurity ion, such as boron (col 4, lines 43-67; col 2, lines 10-19; col 1, lines 44-64).

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Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F from 8:30 Am to 4:30 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

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Michael Trinh
Primary Examiner